CHAPTER 9

PREFERRED WASTEWATER MANAGEMENT SYSTEM

The discussion in this chapter is based on the assumption that the NDEQ will impose ammonia limits on the City of Lincoln. It is assumed that these requirements will become effective with the issuance of new discharge permits for both the Theresa Street and Northeast WWTFs, which are expected sometime in 2003. It is also assumed that a compliance period will be allowed before compliance with the new standards is required. An additional assumption is that the SSO regulations will be adopted in a form similar to that currently proposed.

Preferred System Description

The preferred or recommended wastewater management system for the City of Lincoln to provide wastewater collection and treatment services through 2025 includes:

1. Upgraded and expanded wastewater collection facilities to accommodate existing needs and serve areas of new development within the Lincoln wastewater service area.

2. Upgrade and expansion of the Theresa Street WWTF to provide full nitrification treatment capacity for a maximum month flow of 27 mgd plus peak wet weather capacity to handle flows of 110 mgd.

3. Upgrade and expansion of the Northeast WWTF to provide full nitrification treatment capacity for a maximum month flow of approximately 11 mgd plus peak wet weather capacity to handle flows of 46 mgd.

Details regarding each aspect of the preferred system are presented in subsequent paragraphs.

The pipeline alignments and wastewater treatment facility descriptions included herein were developed for planning purposes only. Design assumptions and specific criteria should be further investigated and defined when specific project implementation begins. Although the final design features may deviate from those described herein, these facilities are representative of the facilities needed by the City of Lincoln and can be used reliably for long-range planning.

Collection System Improvements. A number of improvements to the existing wastewater collection system are recommended. These recommendations are summarized in Table 8-1 in Chapter 8.

The Lincoln wastewater collection system must also be expanded to accommodate anticipated growth. The costs associated with the collection system improvements and upgrades recommended to serve future growth are summarized in Tables 9-1 and 9-2. Table 9-1 summarizes the collection system improvements and upgrades recommended to meet service needs within the next 25 years.

Table 9-1. Summary of Recommended Trunk Sewer Improvements to Serve Tier I Needs (A & B Priority).

Basin	Upstream Manhole	Downstream Manhole	Existing Line Diameter (in)	Length (ft)	Total $	Notes
Priority A						
Antelope Creek	D1-302	D2-42	30	5,704	770,000	24" pipe to parallel this line
Beals Slough	B1-239	SVT Relief Sewer	varies	7,400	1,740,000	36" pipe to parallel this line (Phase I)
Beals Slough	C0-119	B1-239	varies	13,000	3,060,000	36" pipe to parallel this line (Phase II)
Beals Slough	extends to the east	new manhole	27	2,900	480,000	Extension of 27" line
Beals Slough	extends to the south	D0-62	30	5,600	1,090,000	Extension of 30" line
Little Salt Creek	C7-343	C7-342	varies	NA	200,000	3-2400 gpm pumps needed
Little Salt Creek	Lift station C-11	TSP	varies	7,427	1,750,000	36" pipe to parallel this line
Lynn Creek	A9-63	A9-62	10	200	30,000	Pipe burst to a minimum 12" diameter
Lynn Creek	B8-67	B7-342	21	780	200,000	Pipe burst to a minimum 24" diameter
Lynn Creek	B7-341	B7-340	24	503	140,000	Pipe burst to a minimum 27" diameter
NE Salt Creek	extends to the north	NEP	NA	10,025	2,360,000	Stubout of 36" line to the north
Oak Creek	AA7-10	AA7-6	27	452	90,000	36" pipe to parallel this line
Oak Creek	extends to the north	AA8-166	30	840	160,000	Stubout of 30" line to the north
Oak Creek	AA7-21	AA7-10	27	2,196	300,000	24" pipe to parallel this line
Oak Creek	AA7-6	AA7-298	30	2,365	560,000	36" pipe to parallel this line
Oak Creek	A6-209	A6-208	48	98	40,000	54" pipe to parallel this line
Oak Creek	B6-321	B6-319	54	438	70,000	27" pipe to parallel this line
Oak Creek	B6-318	B6-76	27	119	20,000	27" pipe to parallel 54" line
Salt Creek	Old Cheney Rd	Pioneer Blvd	24	5572	1,730,000	48" pipe to parallel this line (Phase V)
Salt Creek	Pioneer Blvd	Van Dorn Pkwy	36	6350	2,950,000	60" pipe to parallel this line (Phase IV)
Salt Creek	Van Dorn Pkwy	"M" St	42	9396	4,370,000	60" pipe to parallel this line (Phase III)
Salt Creek	"M" St	Vine St	48	4635	3,480,000	78" pipe to parallel this line (Phase IIB)
Salt Creek	extends to the south	B0s-37	48	5,000	1,550,000	Construct 48" pipe
West "O" Street	extends to the west	new manhole	36	4,650	1,090,000	Stubout of 36" line to the west
West Salt Creek	extends to the south	B0-151	NA	7,500	3,490,000	New construction of 60" pipe
West Stevens Creek	NA	NA	NA	11,000	6,820,000	New construction of 72" pipe
West Stevens Creek	NA	NA	NA	7,000	5,040,000	New construction of 78" pipe
West Stevens Creek	NA	NA	NA	4,500	4,500,000	New construction of 102" pipe
Other Improvements					10,000,000	
					58,080,000	
Priority B						
Deadmans Run	D5-153	C6-195	varies	11,265	1,580,000	21" pipe to parallel this line
Haines Branch	extends to the south	B3-472	8 & 12	5,300	2,170,000	Replace with 36" line
Middle Creek	A3-191	A4-21	varies	10,000	4,650,000	Replace or parallel with new 42" pipe
West "O"	A4-66	B5-57	12	3357	740,000	30" pipe to parallel this line
West Stevens Creek	NA	NA	NA	8,000	3,120,000	New construction of 54" pipe
West Stevens Creek	NA	NA	NA	10,000	5,400,000	New construction of 66" pipe
Other Improvements					6,500,000	
					24,160,000	
				Total:	82,240,000	

NA = Not Applicable.

Table 9-2. Summary of Recommended Collection System Improvements to Serve Tier II Needs

Basin	Upstream Manhole	Downstream Manhole	Existing Line Diameter (in)	Length (ft)	Unit Cost* ($)	Total $	Notes
Little Salt Creek	C7-343	C7-342	varies	NA	65,000	65,000	1 additional pump needed to fill out ex. sta. (C-11 - 2400gpm)
Middle Creek	AA3-11	A3-191	varies	2,610	465	1,214,000	Replace or parallel line with new 42" pipe
Middle Creek	A4-21	A4-206	21	NA	65,000	65,000	One 2400 gpm pump in lift station (C-9) if there is room
Salt Creek	extends to the east	prop. 48" line	NA	4,850	235	1,140,000	New construction of 36" pipe
West "O" Street	A5-141	A5-42	varies	NA	NA	400,000	New lift station (replacing C-8) with two pumps rated at 2400 gpm
West Salt Creek	extends to the south	prop. 60" line	NA	16,700	465	7,766,000	New construction of 60" pipe
West Stevens Creek	NA	NA	NA	7,000	235	1,645,000	New construction of 36" pipe
West Stevens Creek	NA	NA	NA	9,000	285	2,565,000	New construction of 42" pipe
West Stevens Creek	NA	NA	NA	5,700	465	2,650,500	New construction of 60" pipe to serve East Stephens Creek
				Tier II total		**$ 17,510,500**	

**NA = Not Applicable.

All costs are presented in 2002 dollars. Future development in the Lincoln service area may vary in both timing and location from what is projected in this report. As development occurs, the wastewater collection service plan should be revised and updated appropriately.

Theresa Street WWTF Improvements. For the Theresa Street WWTF, Alternative 4 as presented in Chapter 8 is the preferred alternative. Alternatives 1 and 3 were ruled out primarily because of the risk of implementing capital improvements at a remote facility (Cook Foods) and then having that facility close for some reason in the future. Alternatives 2 and 3 include the implementation of a side-stream treatment train to reduce the organic and ammonia loading on the main treatment facility. Although this is a viable alternative and worth investigating, it is only experimental at this time and the precise impact on the main treatment facility is uncertain. There are few operating facilities that treat strictly an ammonia laden side-stream. A more conventional method of handling the side-stream would be flow equalization to allow consistent return of the dewatering filtrate to the main process flow stream. This approach has been incorporated into Alternative 4. Therefore, Alternative 4 is identified as the most prudent approach to provide long-term nitrification capacity at the Theresa Street WWTF at this time.

Northeast WWTF Improvements. It is recommended that the additional nitrification capacity required at the Northeast WWTF be provided through refurbishing the biotowers and expansion of the activated sludge system. There is a question of the cost effectiveness of rehabilitating the existing biotowers, and it is recommended that this issue be investigated thoroughly as part of the preliminary design effort for the Northeast WWTF nitrification expansion project.

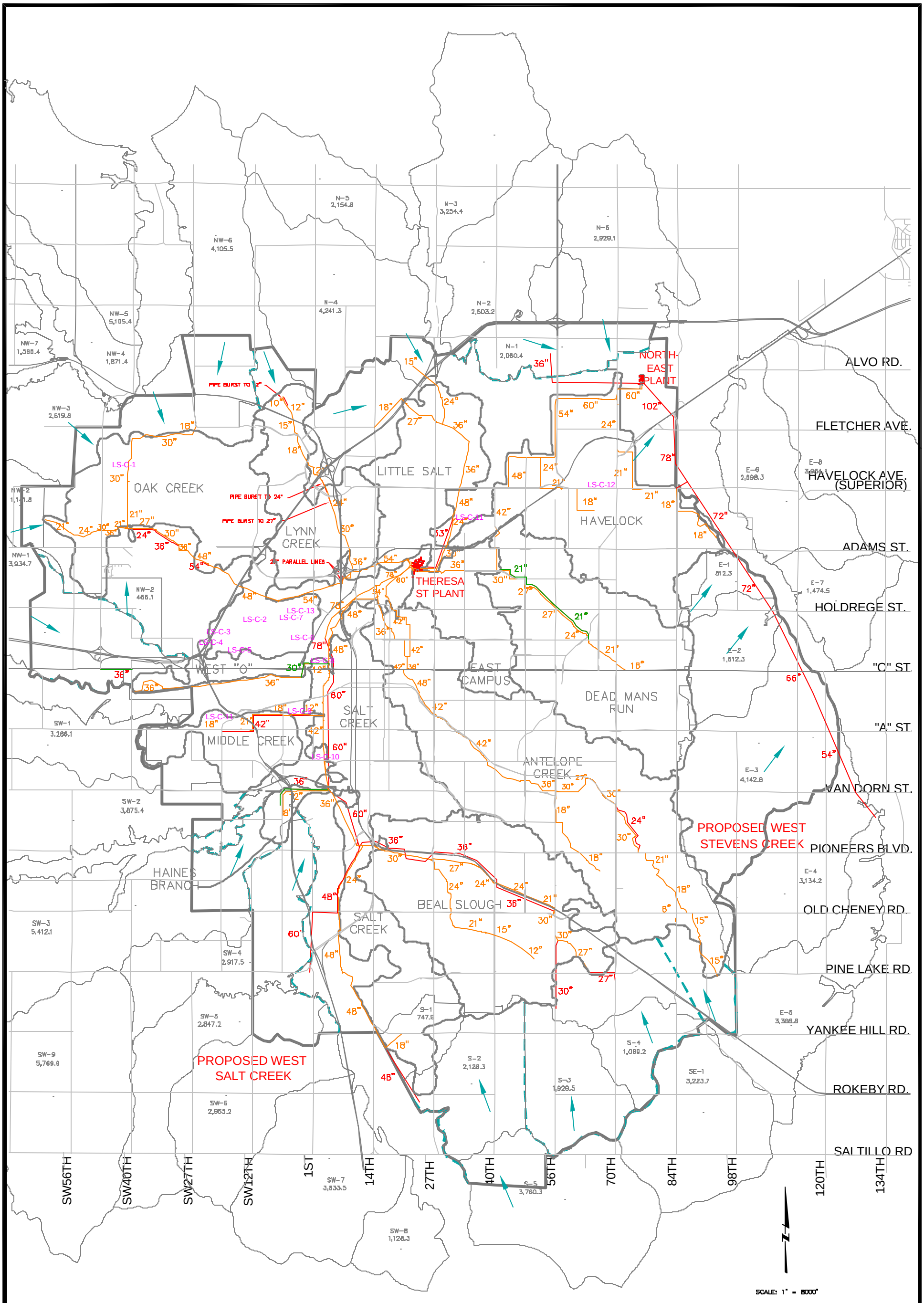
Wet Weather Flows. For both the Theresa Street and Northeast WWTFs, it is recommended that excess wet weather flows be handled with off-line storage or other facilities that will allow the degree of treatment required by the SSO regulations without excessively oversizing the wastewater treatment facilities.

Figure 9-1 shows the recommended collection system facilities associated with the preferred system (Tier I improvements) and Figures 9-2 and 9-3 depict general site plans for the recommended Theresa Street and Northeast treatment facilities respectively.

General Considerations

In implementing the specific improvements indicated for the WWTFs, it is recommended that consideration be given to the following issues:

1. Odor Control – It is anticipated that odor control will become an increasingly important aspect of wastewater treatment for the City of Lincoln. It is recommended that all projects involving improvements to potentially odor generating wastewater treatment processes include installation of appropriate odor mitigation measures. Air pollution control requirements should also be addressed in conjunction with odor control.



TIER IB SEWER LINES IN GREEN
PROPOSED SEWER LINES IN RED
EXISTING SEWER LINES IN ORANGE

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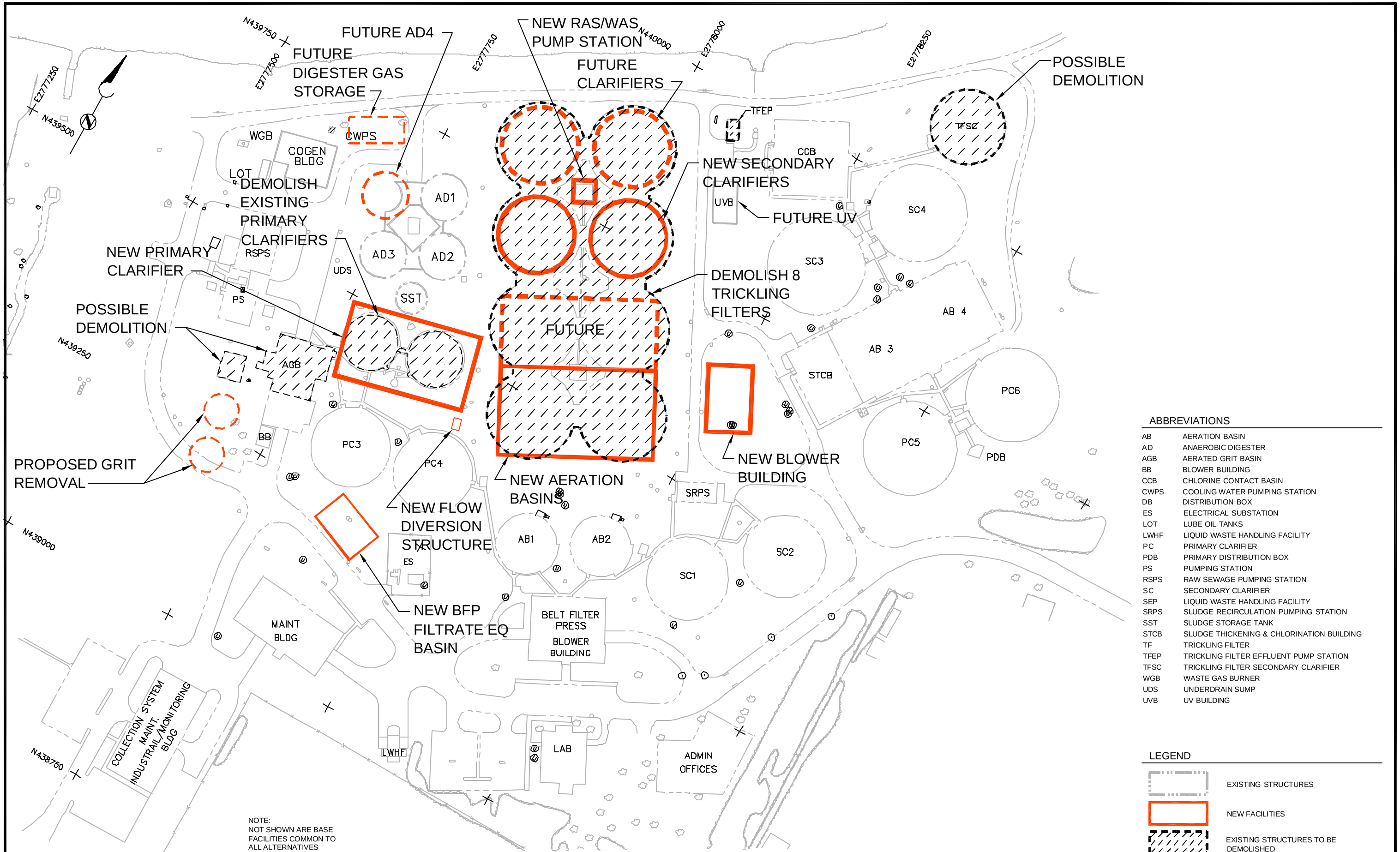
SANITARY SEWER BASINS

Figure 9-1
RECOMMENDED TIER I COLLECTION SYSTEM IMPROVEMENTS



ABBREVIATIONS

AB	AERATION BASIN
AD	ANAEROBIC DIGESTER
AGB	AERATED GRIT BASIN
BB	BLOWER BUILDING
CCB	CHLORINE CONTACT BASIN
CWPS	COOLING WATER PUMPING STATION
DB	DISTRIBUTION BOX
ES	ELECTRICAL SUBSTATION
LOT	LUBE OIL TANKS
LWHF	LIQUID WASTE HANDLING FACILITY
PC	PRIMARY CLARIFIER
PDB	PRIMARY DISTRIBUTION BOX
PS	PUMPING STATION
RSPS	RAW SEWAGE PUMPING STATION
SC	SECONDARY CLARIFIER
SEP	LIQUID WASTE HANDLING FACILITY
SRPS	SLUDGE RECIRCULATION PUMPING STATION
SST	SLUDGE STORAGE TANK
STCB	SLUDGE THICKENING & CHLORINATION BUILDING
TF	TRICKLING FILTER
TFEP	TRICKLING FILTER EFFLUENT PUMP STATION
TFSC	TRICKLING FILTER SECONDARY CLARIFIER
WGB	WASTE GAS BURNER
UDS	UNDERDRAIN SUMP
UVB	UV BUILDING

LEGEND

EXISTING STRUCTURES

NEW FACILITIES

EXISTING STRUCTURES TO BE DEMOLISHED

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Lincoln Wastewater System Facilities Plan Update
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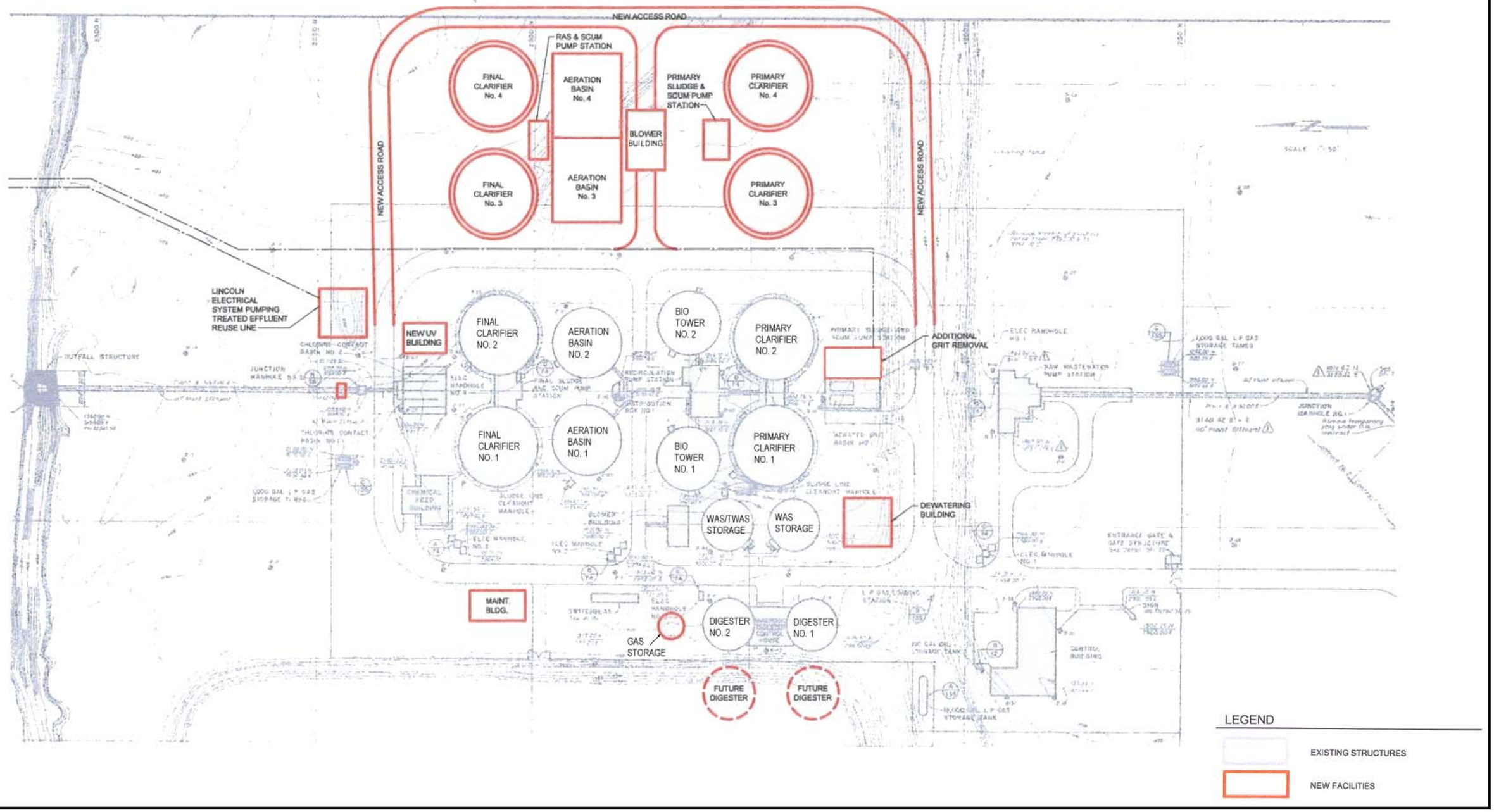
THERESA STREET WASTEWATER TREATMENT PLANT

Figure 9-2
Recommended Conceptual Theresa Street Site Plan



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Lincoln Wastewater System Facilities Plan Update

CITY OF LINCOLN

NORTHEAST WASTEWATER TREATMENT PLANT

Figure 9 - 3

Recommended Conceptual Northeast Site Plan

2. Additional Nitrification Capacity – As indicated by the population projections presented in Chapter 3 and the wastewater flow and loading projections presented in Chapter 5, it is anticipated that the population of the Lincoln Wastewater Service area will continue to grow beyond 2025. For this reason, it is recommended that consideration be given in all improvement projects at both the Theresa Street and Northeast WWTFs to the need for facilities to accommodate wastewater treatment capacity requirements beyond 2025.

3. Future Treatment Requirements – As discussed in Chapter 6, it is anticipated that nutrient limits may be placed on discharges from both the Theresa Street and Northeast WWTFs at some point in the future. Planning for any additional treatment or auxiliary facilities at the Theresa Street or Northeast WWTF sites should give consideration to the space and hydraulic requirements of facilities that may be required in the future to accommodate nutrient removal. It may be necessary to purchase additional land adjacent to the existing treatment sites to accommodate this recommendation. Figures 9-4 and 9-5 show possible locations and site area requirements associated with facilities to accommodate potential future treatment requirements.

Preferred Treatment System Costs

Tables 9-3 and 9-4 summarize the estimated capital costs of the treatment facilities recommended to meet future needs from 2002 through 2025. The costs in these tables are total project costs and include allowances for planning, pre-design, design, bidding, construction, construction management, start-up, legal, and administration costs. All costs are stated in terms of 2002 dollars.

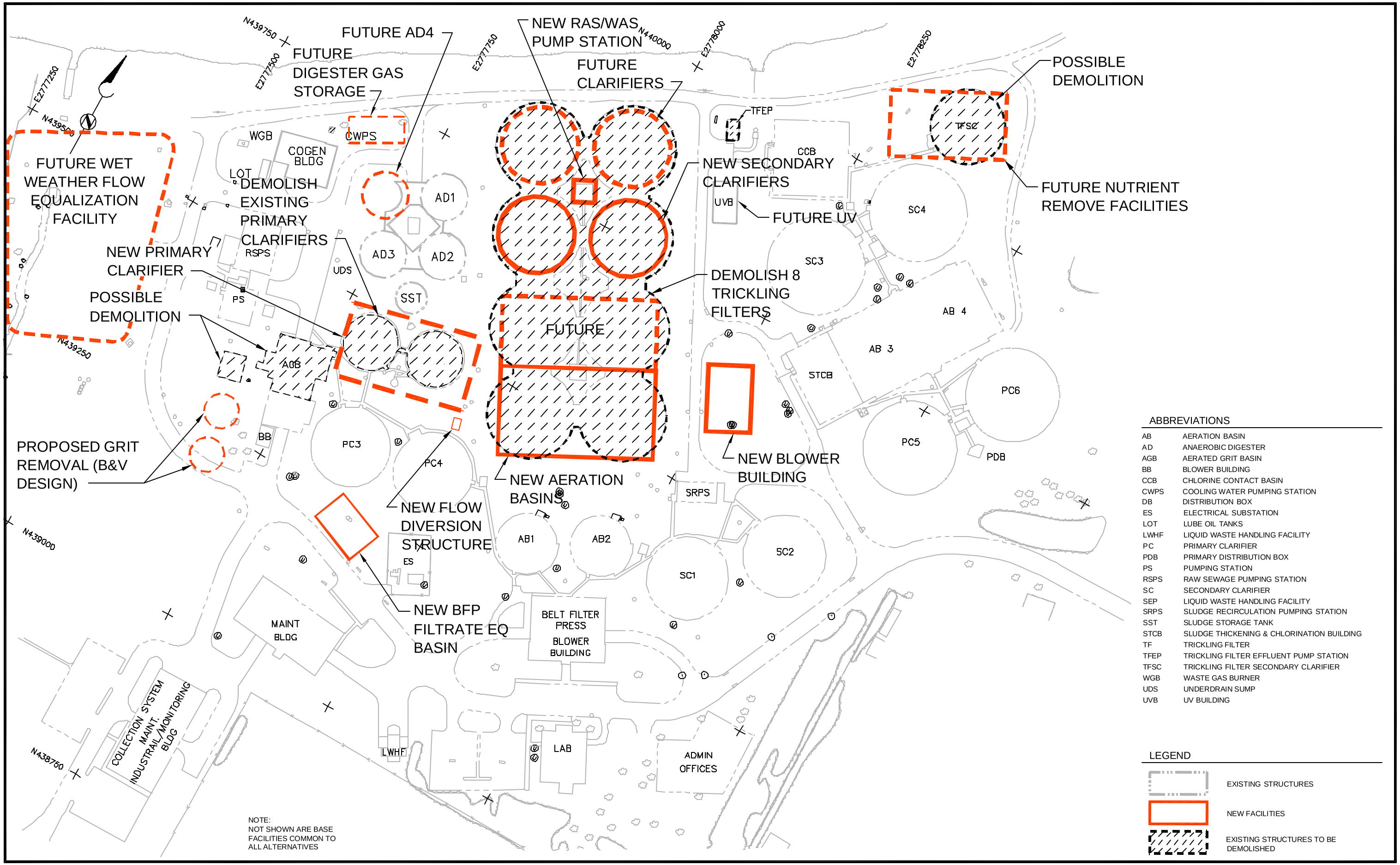
Implementation of Preferred System

It is recommended that the preferred system be implemented in stages over multiple years. The timing for construction of the recommended facilities system is contingent upon promulgation of future regulations and service area population growth rates. Adjustments to the timing of facilities construction may be required as future development occurs and regulations and discharge limits are adopted.

Figure 9-6 depicts the anticipated implementation schedule for the selected improvements. The schedule includes the time required for total project implementation beginning with preliminary design and concluding with start-up. The implementation schedule is divided into three categories:

1. Collection System,
2. Theresa Street WWTF, and
3. Northeast WWTF.

Each of these categories is discussed individually in the following paragraphs:



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Lincoln Wastewater System Facilities Plan Update
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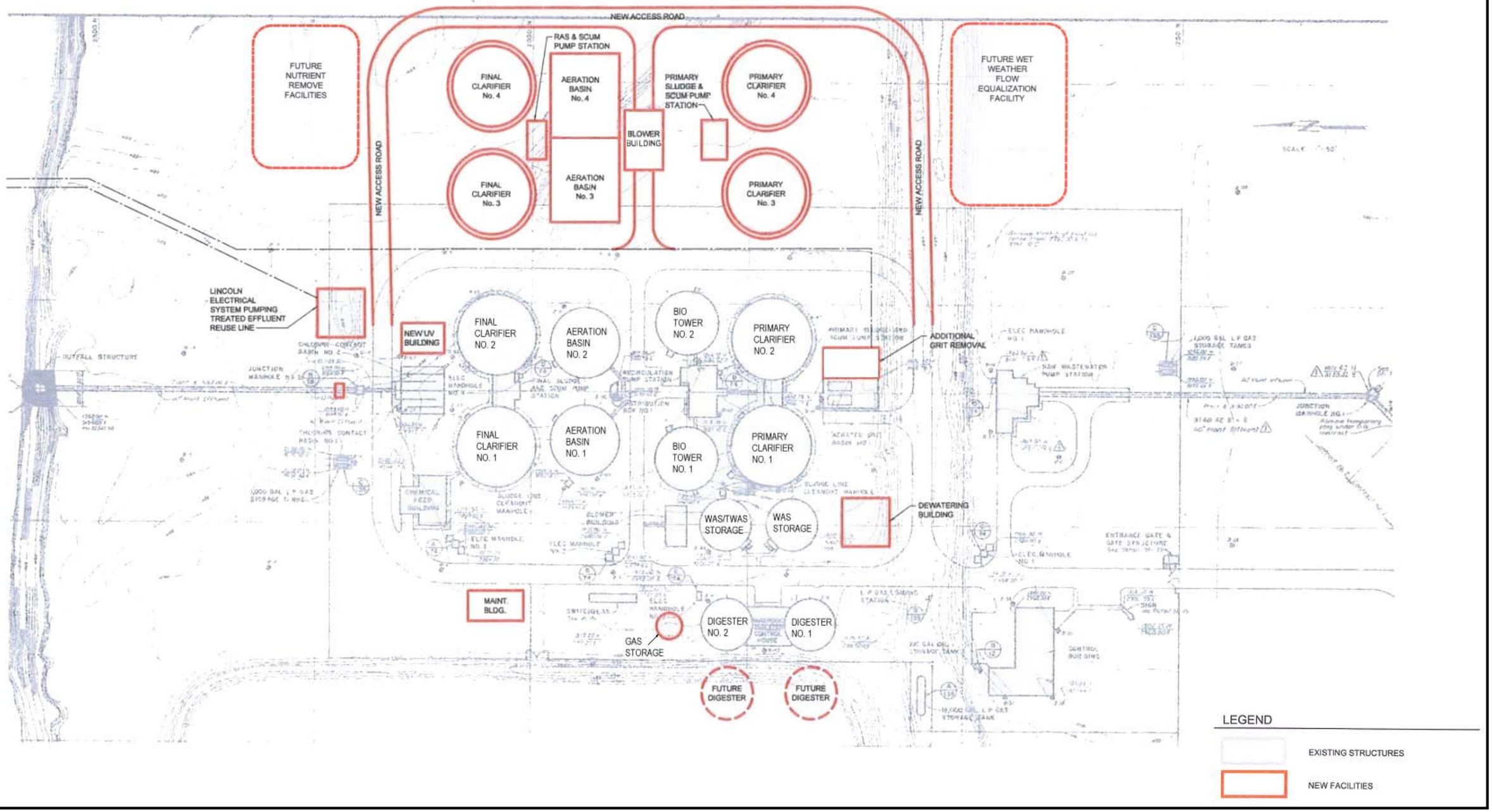
THERESA STREET WASTEWATER TREATMENT PLANT

Figure 9-4
Theresa Steet WWTF Conceptual Site Plan-Future



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Lincoln Wastewater System Facilities Plan Update

CITY OF LINCOLN

NORTHEAST WASTEWATER TREATMENT PLANT

Figure 9 - 5

Northeast WWTF Conceptual Site Plan - Future

Figure 9-6 Lincoln Capital Improvement Schedule

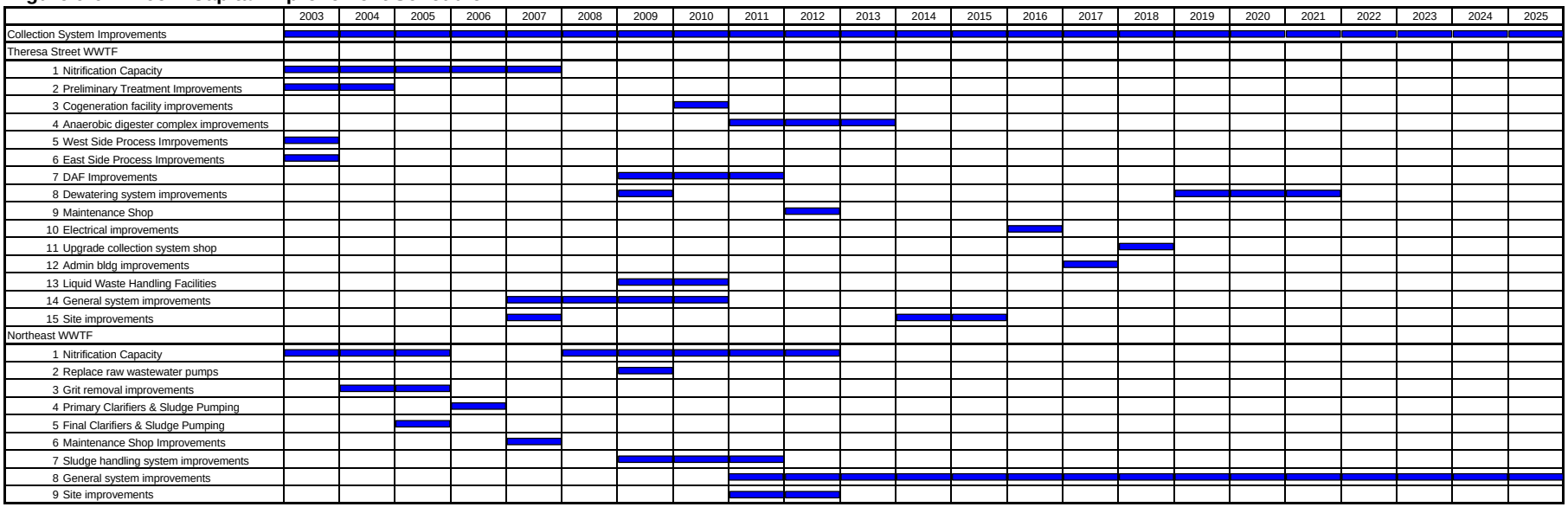

Table 9-3. Theresa Street WWTF Estimated Capital Improvement Costs (2003 through 2025)

Item	Total Project Cost
13 mgd Additional Nitrification Capacity	$22,700,000
Preliminary Treatment Improvements	$6,400,000
Cogeneration Facility Improvements	$300,000
Anaerobic Digester Complex	$6,600,000
West Side Process Train	$2,600,000
East Side Process Train	$6,600,000
Dissolved Air Flotation	$2,500,000
Sludge Dewatering System Improvements	$5,800,000
Maintenance Shop Rehabilitation	$600,000
Electrical System Improvements	$500,000
Collection System Shop Upgrade	$500,000
Administration Building Improvements	$600,000
Liquid Waste Handling Facility Improvements	$1,300,000
General Hydraulic and System Improvements	$30,500,000
General Plant Site	$2,500,000
Total Estimated Project Cost	**$90,000,000**

Table 9-4. Northeast WWTF Estimated Capital Improvement Costs (2003 through 2025)

ITEM	Total Project Cost
6 mgd Nitrification Capacity	$11,600,000
Operations Center Upgrade	$3,100,000
Raw Wastewater Pumps Replacement	$1,500,000
Grit Removal Improvements	$1,000,000
Primary Sludge Clarifiers and Pumping Improvements	$1,200,000
Refurbish Biotowers	$2,500,000
Secondary Clarifier Improvements	$1,200,000
Maintenance Shop Improvements	$300,000
Sludge Handling System Improvements	$9,000,000
General Hydraulic and System Improvements	$23,000,000
General Site Improvements	$600,000
Total Estimated Project Cost	**$55,000,000**

Collection System. The timing of collection system improvements is driven by capacity needs. The downstream section of the Salt Valley system is in need of relief in the near future. Other interceptor sections of the Salt Valley system, along with the Little Salt Creek collection facilities, are projected to need relief capacity within the next 6 years. Due to the potential increase in service area identified in the 2002 Lincoln/Lancaster County Comprehensive Plan, significant investments in the Salt Valley relief sewer may again be required in 5 to 7 years and again in 12 to 18 years.

The collection system improvements are driven by growth. Therefore, any change in anticipated growth patterns or rates will necessitate a subsequent change in the required timing of the collection system improvements. In addition to the needs identified herein, the City also must repair and/or replace other portions of the collection system that fail due to age, damage, or unforeseen circumstances. An allowance should be provided in the capital improvement budget to address these situations when they occur.

Theresa Street WWTF. Since the Theresa Street WWTF does not have sufficient nitrification capacity to handle current or projected flows, significant improvements will be required as soon as effluent ammonia limits are imposed and final compliance dates are established. These include demolishing the trickling filter system and replacing it with a new nitrifying activated sludge system. This new system should provide sufficient nitrifying capacity so the entire Theresa Street WWTF can comply with ammonia limits through 2025.

Because of the expected timing of a national policy regarding SSOs, it is recommended that construction of any facilities related to treatment of peak wet weather flows be deferred until the policy is adopted. However, it is recommended that preliminary engineering begin as soon as possible to define the type, size, and location of facilities necessary to handle peak wet weather flows. Any changes to the treatment system undertaken before the SSO policy is adopted should be designed to accommodate the planned peak wet weather flow facilities.

Northeast WWTF. As with the Theresa Street WWTF, the Northeast WWTF does not have adequate nitrification capacity to treat existing or projected wastewater flows. Therefore, expansion of the Northeast wastewater treatment capacity should be considered as soon as effluent ammonia limits are imposed.

The City of Lincoln does have the capability to divert a portion (up to 4 mgd) of the wastewater normally treated at the Northeast WWTF to the Theresa Street WWTF for treatment. This capability provides the City of Lincoln the opportunity to defer the capital investment required to increase the nitrification capacity of the Northeast WWTF for some period of time, probably 5 to 10 years. This capability may be limited to some extent by the digester capacity available at Theresa Street WWTF. However, the seasonal loading variations typically experienced are expected to result in sufficient digester capacity loading available at Theresa Street to accommodate Northeast diversion requirements through 2012.

It is recommended that the City utilize this flow diversion capability to defer the major capital improvements required to increase the nitrifying capacity of the Northeast WWTF. This will allow the City to spread the needed capital improvements over a longer period of time and subsequently reduce the immediate capital outlay.

Immediate improvements recommended at the Northeast WWTF include the installation of facilities to reduce the impact of sludge supernatent return flows on the wastewater treatment process, acquisition of more land for sludge utilization or other provisions to increase sludge disposal capacity, and renovation of the existing biotowers. The other improvements identified in Chapter 8 for the Northeast WWTF should be implemented as the needs develop.

As discussed above, the expected timing of a national policy regarding SSOs suggests deferring any projects related to treatment of peak flows until the policy is available. It is recommended that preliminary engineering begin as soon as possible to define the type, size, and location of facilities to handle peak wet weather flows and that any treatment system improvements implemented before the SSO regulations are promulgated be designed to accommodate the planned peak flow facilities.

Cooling water from the new Lincoln Electric Power generation facility is to be returned to the Northeast WWTF for treatment. Information on the quantity, quality, and temperature of this return flow was not available at the time of this writing. The preliminary design for any improvements at the Northeast WWTF should address the issue of this return flow.

As discussed previously, it may be possible to utilize the pipeline that returns the power plant cooling water to the Northeast WWTF to convey supernatent from the sludge storage lagoon to the Northeast WWTF as well. This possibility should be investigated more thoroughly during preliminary design.

Anticipated Capital Expenditures

The projected Tier I collection system trunk sewer improvements are presented in Table 9-1. The schedule for implementing these improvements depends largely on the timing and location of growth within the Lincoln wastewater service area. The Tier I collection system trunk sewer improvements are expected to cost approximately $82,000,000 and to be implemented between 2003 and 2025. In addition to the specific costs identified for the collection system trunk lines, other system capital costs of $32,000,000 are also anticipated for the period from 2003 to 2025. These costs have been incorporated into the costs presented in Figure 9-7.

The anticipated capital costs for the Theresa Street and Northeast WWTFs over the period from 2003 to 2025 are expected to be $90,000,000 and $55,000,000, respectively.

These anticipated capital costs are summarized in Table 9-5.

Table 9-5. Tier I Improvement Costs[1]

	Tier I (25-Year) Costs
Collection System Trunks Sewers	$82,000,000
Theresa Street WWTF Improvements	$90,000,000
Northeast WWTF Improvements	$55,000,000
General System Improvements	$32,000,000
Totals Costs	**$259,000,000**

[1] All costs are in 2002 dollars.

Figures 9-8 and 9-9 present the anticipated capital improvement funding requirements for the Theresa Street and Northeast WWTF improvements respectively. These figures represent a schedule of the expenditures necessary to implement the preferred system according to the schedule shown on Figure 9-6.

Figure 9-10 presents the anticipated combined capital expenditures for the collection system and the Theresa Street and Northeast WWTFs for the period from 2003 through 2025. All of the values shown in Figures 9-7, 9-8, 9-9, and 9-10 are presented in 2002 dollars.

Figure 9-7 Lincoln WW Collection System Projected Capital Expenditures

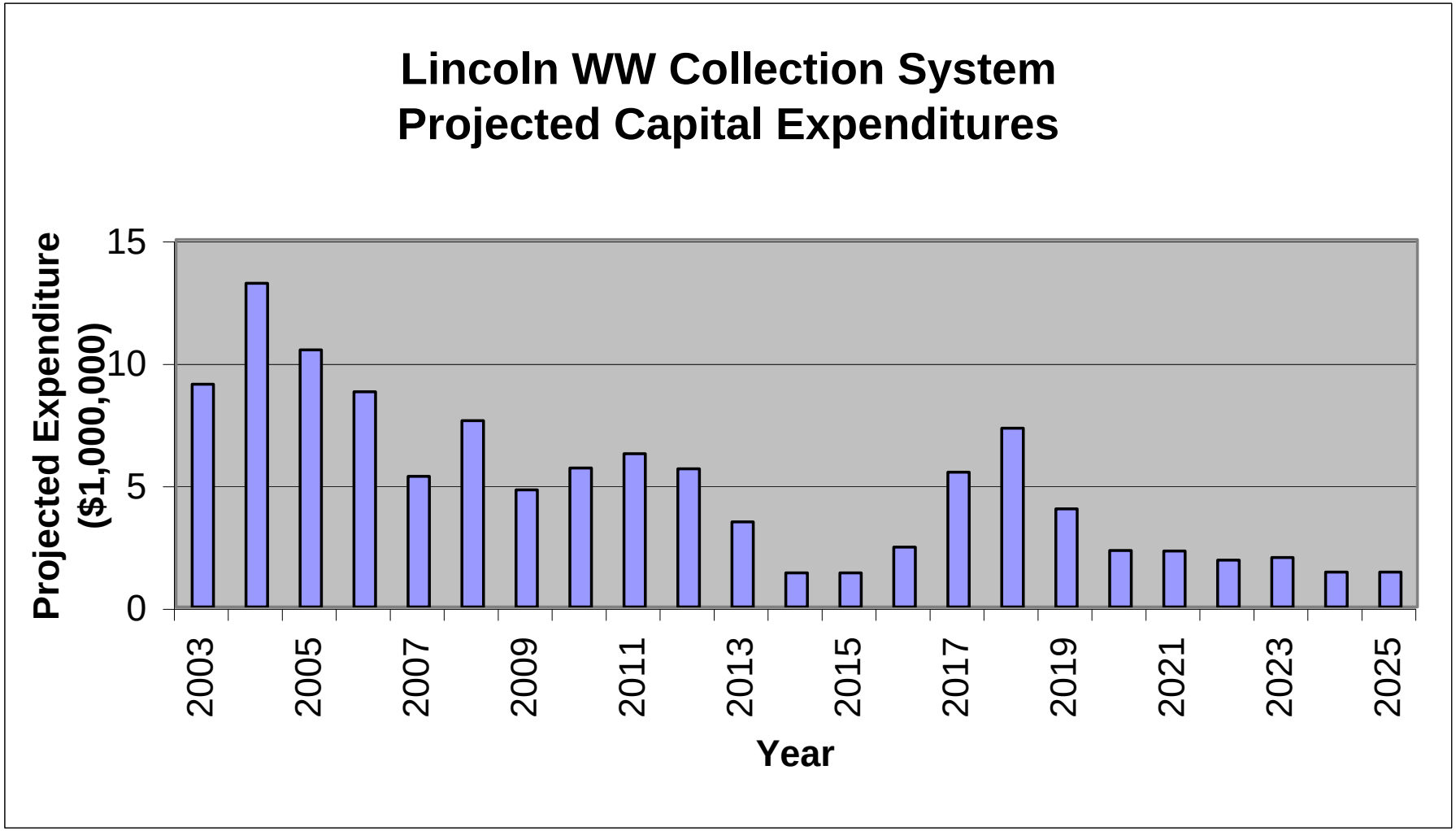

Figure 9-8 Theresa Street WWTF Projected Capital Expenditures

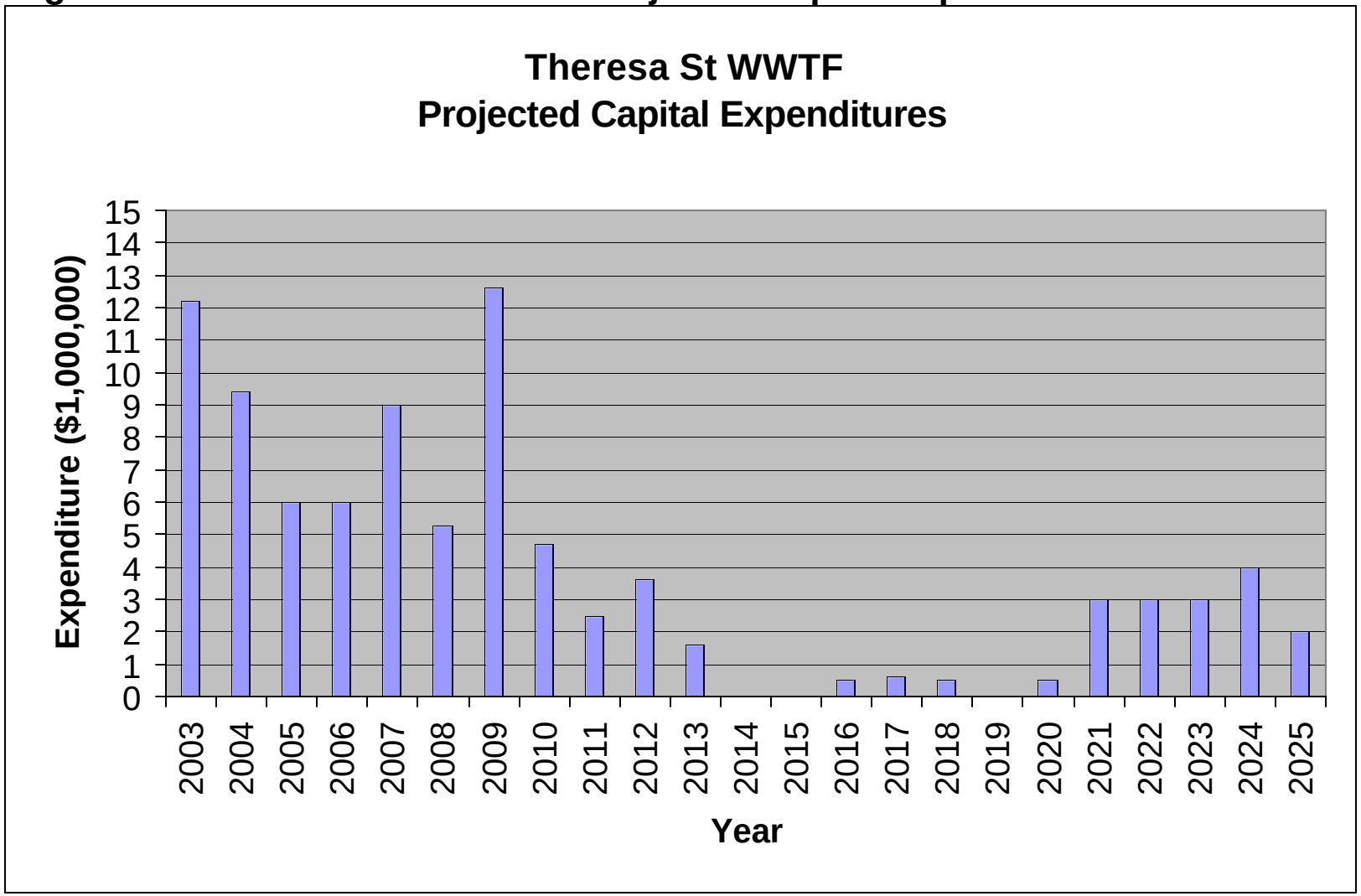

Figure 9-9 Northeast WWTF Projected Capital Expenditures

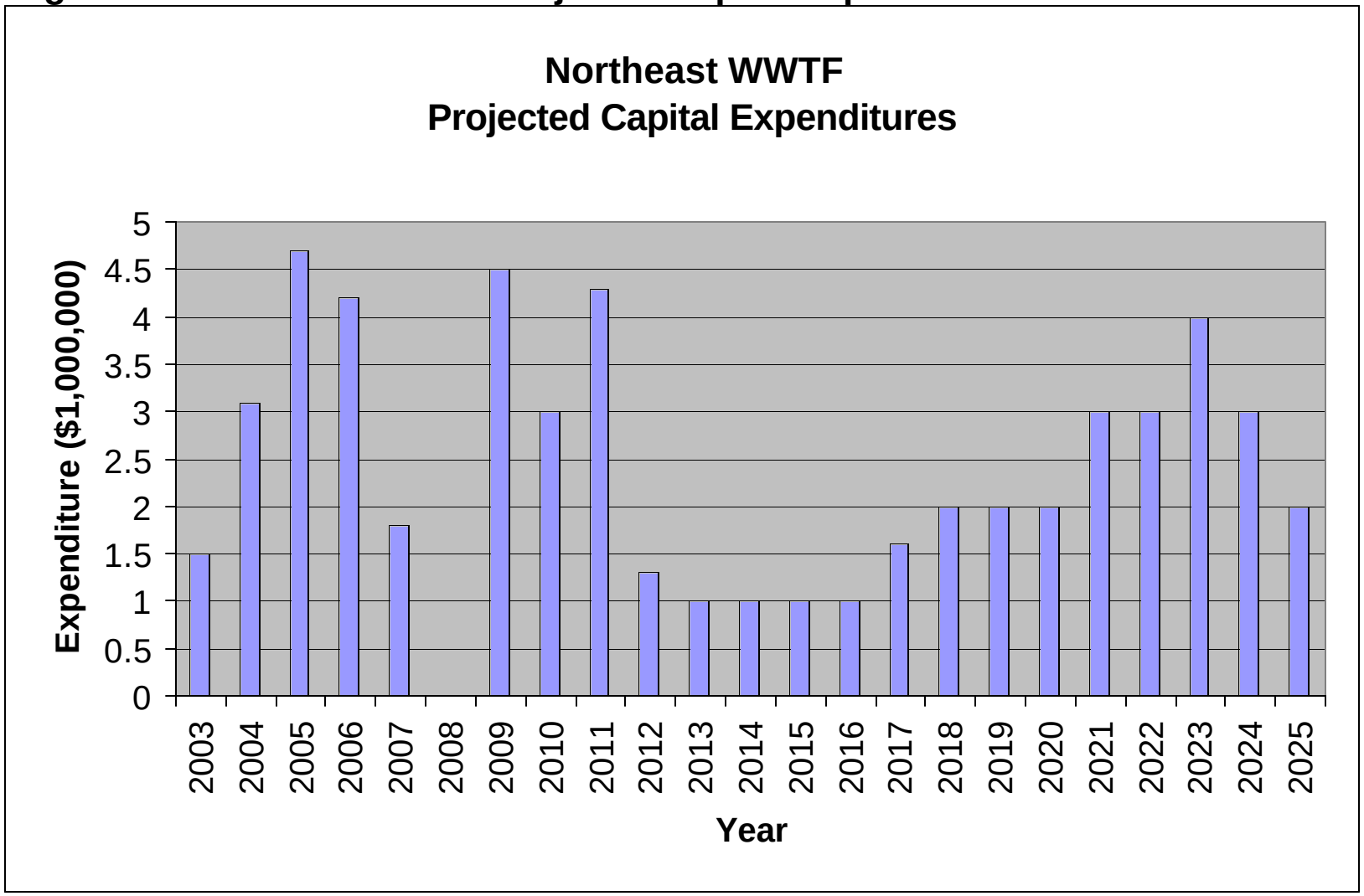

Figure 9-10 Total Lincoln Wastewater Projected Capital Expenditures